CHLORETONE AS A HYPNOTIC. F. F. Ward (Medicine, August, 1900, No. 8).

The author regards this drug as the best general hypnotic. He thinks that it is more certain than trional and sulfonal and less harmful. The only after-effect observed was a slight headache after taking the drug for several nights. He makes use of its sedative and local anesthetic effects in excessive hyperacidity due to nervous disease, in epigastric pain which interrupts sleep, and in acute alcoholism. In this latter it should be given in ten-grain doses in half an ounce of whiskey or brandy, followed in fifteen minutes by a raw egg beaten in milk. Ordinarily the dose is three to five grains in powder, capsule or in whiskey, repeated, if desirable. It is soluble 1-100 in water and 1-12 in alcohol. JELLIFFE.

## PSYCHOLOGY.

ON RELATIONS OF TIME AND SPACE IN VISION. J. M. MCKEEN CATTELL (Psychological Review, VII, 4, July, 1900. Pp. 325-343).

Rarely has psychology offered to philosophy stronger absolute, that is, experimental, evidence of the necessity of the idealistic viewpoint than this article by Professor Cattell, of Columbia, presents. Its results are important to epistemology, for they demonstrate under practically the conditions of every day experience that what is objectively a time-series may appear subjectively as a space-continuum. More than this, the research corroborates many others in demonstrating that what one "sees," proverbially, to the average man, so sure, depends more on personal, or at any rate on racial, "utility and the whole content of present and past experience" than on the object serving as the occasioning stimulus. The visual mechanism, *e. g.*, is proved to be no mere organic machine mechanically photographing objects upon a sensorium, but rather a vital, mental instrument by which in part each personality constructs for itself its own objective world. Rarely does an experimental inquiry bring out this consequence, so trite in idealistic philosophy, but so continually important for the scientific observer, so well and so indisputably.

The article consists of three sections, namely, on "Perception With the Moving Eye," "The Fusion of Moving Objects," and "The Perception of Moving Objects." The two first consider certain facts and theories having close relation to the main purpose of the experiments, while the last describes the research proper. Under the first head there is offered an explanation of the novel fact that "in ordinary vision the spatial world of perception is reconstructed from a series of changes in time of the retinal images." Thus when the retinal elements are stimulated at a rate even over a thousand per second (the eye moving and the objects not) there is perfectly clear vision, a fact which indicates an extreme sensitivity and perfection in the visual mechanism. "We perceive a series of time changes on the retina as a spatial continuum because for our reactions it is in fact a spatial continuum," the rate of successive unitary retinal stimulation being far within the action-time of the cerebral process of conscious perception. Several possible other explanations of the facts are suggested and shown to be probably untenable.

Regarding the fusion of moving objects, the author maintains, with perhaps a slight straining of a highly speculative theory for such an application, that in the development of the perceptive faculties in hereditary, *utility* has been the controlling teleological criterion, so that at present "we perceive what is useful for us to perceive in order to direct our actions so as to preserve ourselves and attain our ends, and we usually perceive things in the way that is most conducive to these ends." If the eyes could move faster than they can (their reaction-time is much longer than that of most bodily parts) it would be of no use, there being no brain mechanism of corresponding quickness. The blurring of rapidly moving objects is in practice no disadvantage, for, thinks the author, the perception of the wholeness of the object is not thereby lost. Complete fusion is never produced by the color-wheel, at least not in Prof. Cattell's experience, there being therefore no true chemical fusion in the retina. After images cannot be cited as contradictory to the extreme sensitiveness of the ocular visual mechanism, for they are undoubtedly cerebral phenomena, the author (like more and more of those familiar with the methods and functions of the brain) having "never cared for the physiological mythology of the Young-Helmholtz and Hering theories of color vision."

In the last section "The Perception of Moving Objects" is experimentally discussed, this section forming the larger mass of the article. Moving objects of two dimensions were exposed to the subjects' view for a very short time and record made by each subject at the time of what they perceived; this in short was the experiment, performed with many sorts of variation off and on for ten years with many subjects. Four sorts of apparatus were devised for this purpose, and are described, and two of them illustrated. One was a mere hand screen, containing a slit which could be moved over a background bearing the object; another instrument was an adaptation of a cylindrical chronograph to the drum of which the object was affixed; a third was a more complex apparatus, combining a pendulum arrangement with a stereopticon for the employment of classes of students as subjects.

The fourth apparatus, that wherewith the most accurate experiments were performed, was a wheel chronoscope devised especially for laboratory work of this sort. This machine cannot fail to be an useful one for many purposes in psychological laboratories. It consists of a wheel, one meter in diameter with a rim about 9 c. m. wide. Cards or colors placed on the outside of the rim pass by a slit in an upright board near by, and may be seen by the subject placed beyond. It is thus possible to exhibit a color or a series of colors for an interval dependent on the rate at which the wheel moves and the size of the colored surfaces. The intensity of the light and the size of the field can also be varied, thus permitting experiments on the relations of time, area, intensity and color in vision. The instant at which the color reaches the slit can be recorded by electric keys on the baseboard of the wheel, thus allowing experiments on discrimination-time and so forth. The wheel can be revolved at a constant rate by a motor, or can be turned by the fall of a weight attached to the inner rim. The latter method was used in these experiments, the wheel being held in position by an electro-magnet and released by pressure on a convenient key, then swinging like a pendulum. At and near the dead-point the rim is moving at a nearly uniform rate, and it is then that the colors pass the slit in the screen for judgment. The rate can be adjusted by the weight's position on the rim; it was in these experiments one meter per second. If, *e. g.*, a green surface 5 c. m. wide is attached to the outer surface of the rim followed by a red surface of like width, the observing subject has over an area of the retina through the slit, say 1 c. m. wide, first green exhibited for $\frac{1}{20}$ second, then following it in the same area red for $\frac{1}{20}$ second.

The experiments on moving objects thus shown briefly to the subjects were varied in many ways, as to rate of motion, time of exposure, area of exposure, number of stimuli, combinations of different colors, shape of the field, intensity of illumination, motion of field before stimulus appeared, movements of eyes during exposure, etc.; only a few of these and the general conclusions are, however, reported in this article. It is the extreme individual variation in the perception which is of chief interest and importance. "With exactly the same stimulus different observers have entirely different perceptions"; this statement, a reproduction of the drawings made by ten advanced students, who successively served as subjects, amply corroborates. No two of these are alike, and in general they are so unlike as to in no wise suggest each other, or a common stimulus. The extreme vagueness of the first perception was to the subject an interesting point in the experience, and only after four or five or more exposures of the same object-stimulus did there arise in the mind a perception sufficiently distinct for the required reproduction with a pen or pencil on the subject's notes. Once attained, the perception was certain enough, sometimes changed on learning what the stimulus really was, but more often not, there being here evidently a rough measure of the power of suggested imagination over the subject's perceptions.

This research opens up interesting and deep-reaching problems for psychology to solve in detail, at which especially genetic psychology would be probably particularly successful, for the perceptual habits which the subjects' reports imply are assuredly neither the product of chance nor too obscurely hid within the experience of the youthful individual to be to some degree at least unrolled. In most general conclusions this research emphasizes two most philosophical propositions—one the practical every day meaning of idealism, the other the inevitable sovereignty of personality as a continuum of experience. GEORGE V. N. DEARBORN.

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A SENATE AMENDMENT to the Sundry Civil Bill, for a Psycho-Physical Laboratory, etc., has been introduced. The amendment reads: "For the establishment in the Department of the Interior of a Psycho-Physical Laboratory. For a salary of the Director of the Laboratory, four thousand five hundred dollars. For expenses incidental to the collection of sociological, anthropological, abnormal and pathological data, including the study of the criminal, pauper and defective classes, and for the preparation of special reports on results of work, and for all necessary printing, sixteen thousand five hunded dollars." This laboratory is not to be in competition with other psycho-physical laboratories in this country. Its purpose is to gather sociological, pathological or abnormal data, as found especially in children, and in criminal, pauper and defective classes, and in hospitals. Besides these data it is desired to gather more special data with laboratory instruments of precision and to make such experiments or measurements as are generally considered of value by psycho-physicists and anthropologists. A great number of specialists in America, and some in Europe, have written letters in favor of a psycho-physical laboratory in the Department of the Interior, and the idea has been endorsed by many of the medical and scientific journals of the United States and Europe. The Government pays out millions to catch, try, and care for criminals, and it would seem to be a good investment for it to establish a laboratory which will have for one of its objects the finding of the causes of crime, pauperism, and other forms of abnormality.

The National Prison Association this fall unanimously passed a resolution in favor of such a laboratory to study criminals.